



Improving water level and soil moisture over peatlands in a global land modeling system

Bechtold, M.^{1,2}, De Lannoy, G.J.M.¹, Roose, D.², Reichle, R.H.³, Koster, R.D.³, Mahanama, S.P.³,

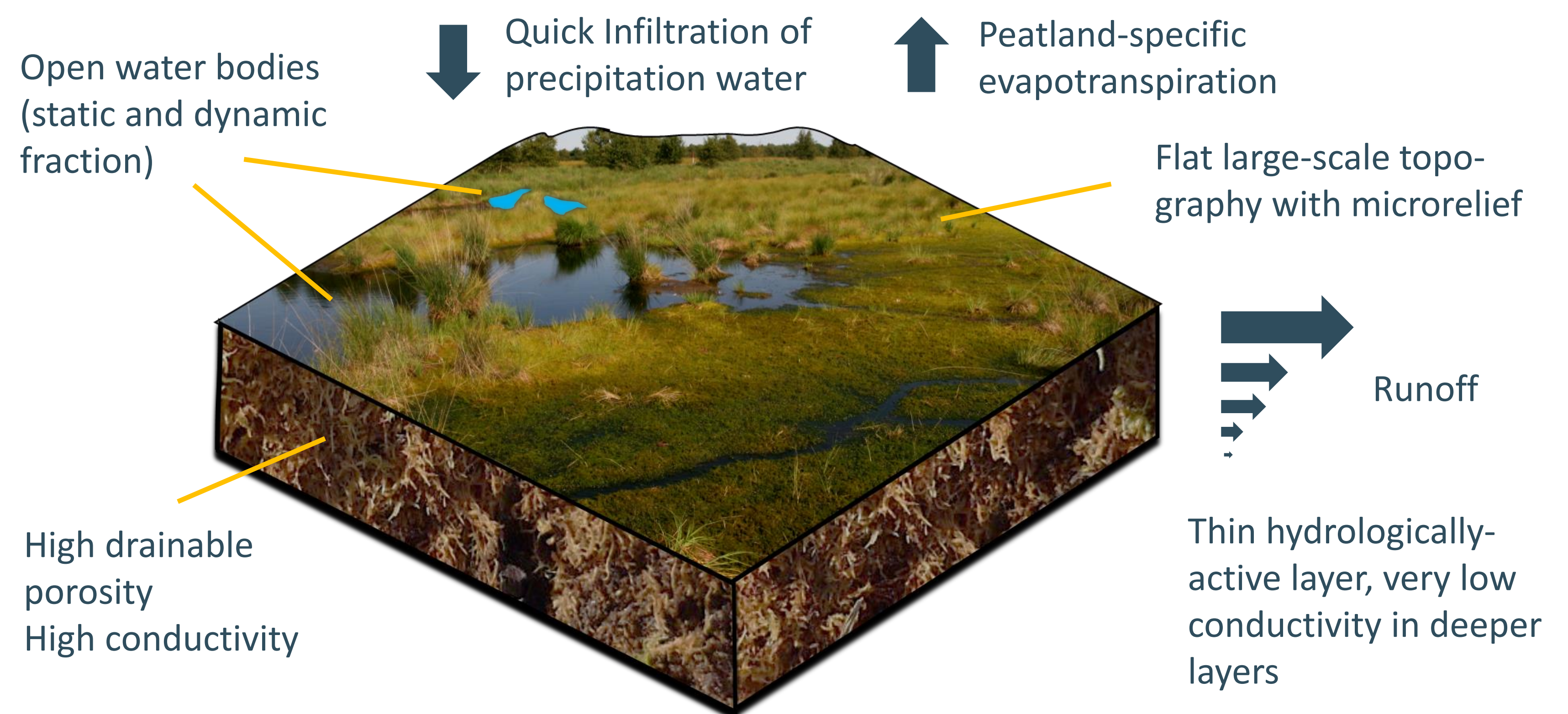
Aurela, M.⁴, Barr, A.⁵, Braumann, F.⁶, Burdun, I.⁷, Drösler, M.⁸, Flanagan, L.B.⁹, Grygoruk, M.¹⁰, Kurbatova, J.¹¹, Lohila, A.¹², Mäck, U.¹³, Mauersberger, R.¹⁴, Munir, T.¹⁵, Röhl, M.¹⁶, Sagris, V.⁷, Thiele, A.¹⁷, Tiemeyer, B.¹⁸, Zak, D.¹⁹, Zauf, M.²⁰

¹KU Leuven, Dept. of Earth and Environmental Sciences, Division Soil and Water Management, Belgium, ²KU Leuven, Dept. of Computer Science, Scientific Computing Research Group, Belgium, ³NASA Goddard Space Flight Center, Global Modeling and Assimilation Office, Greenbelt, Maryland, USA, ⁴Finnish Meteorological Inst., Helsinki, Finland, ⁵Climate Research Branch, Meteorological Service of Canada, ⁶Naturpark Drömling, Germany, ⁷Chair of Physical Geography and Landscape Ecology, Univ. of Tartu, Estonia, ⁸Weihenstephan-Triesdorf Univ. of Applied Sciences, Vegetation Ecology, Germany, ⁹Dept of Biological Sciences, Univ. of Lethbridge, Canada, ¹⁰Faculty of Civil and Environmental Engineering, Warsaw Univ. of Life Sciences – SGGW, Poland, ¹¹A.N. Severtsov Inst. of Ecology and Evolution, Russian Academy of Sciences, Russia, ¹²Finnish Meteorological Inst., Helsinki, Finland, ¹³ARGE Schwäbisches Donaumoos, Germany, ¹⁴Förderverein Feldberg-Uckerländische Seenlandschaft, Germany, ¹⁵Dept of Geography, Univ. of Calgary, Canada, ¹⁶HfWU Nuertingen-Geislingen Univ., Germany, ¹⁷Univ. of Greifswald, Germany, ¹⁸Thünen Inst. of Climate-Smart Agriculture, Braunschweig, Germany, ¹⁹Leibniz-Inst. of Freshwater Ecology and Inland Fisheries, Berlin, Germany, ²⁰Naturschutzfonds Brandenburg, Germany

Motivation

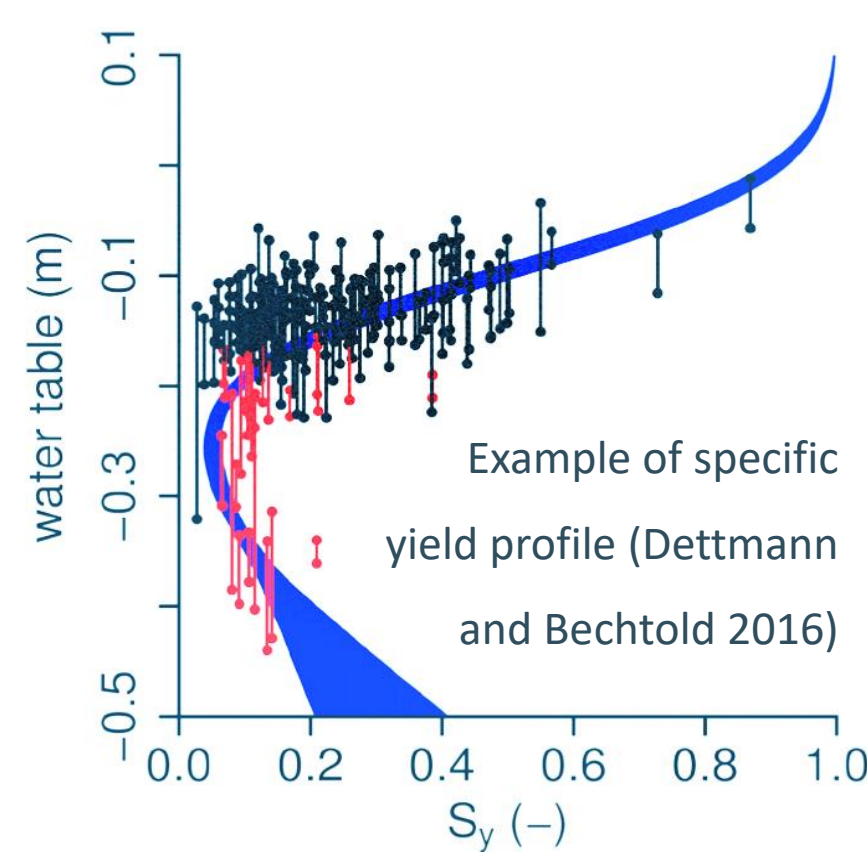
- How do peatlands react to changing climate?
- Model structures of current global land surface models are not able to reproduce typical hydrological dynamics in peatlands
- Objective: Implementation of peatland-specific processes into the GEOS-5 Catchment Land Surface Model (Koster et al. 2000)**
- Next:** Combining satellite observations with land surface modeling over organic-rich regions using data assimilation techniques will provide further improved estimates of geophysical variables in peatlands

Peatland characteristics (rain-fed type)



Model Structure Adjustments

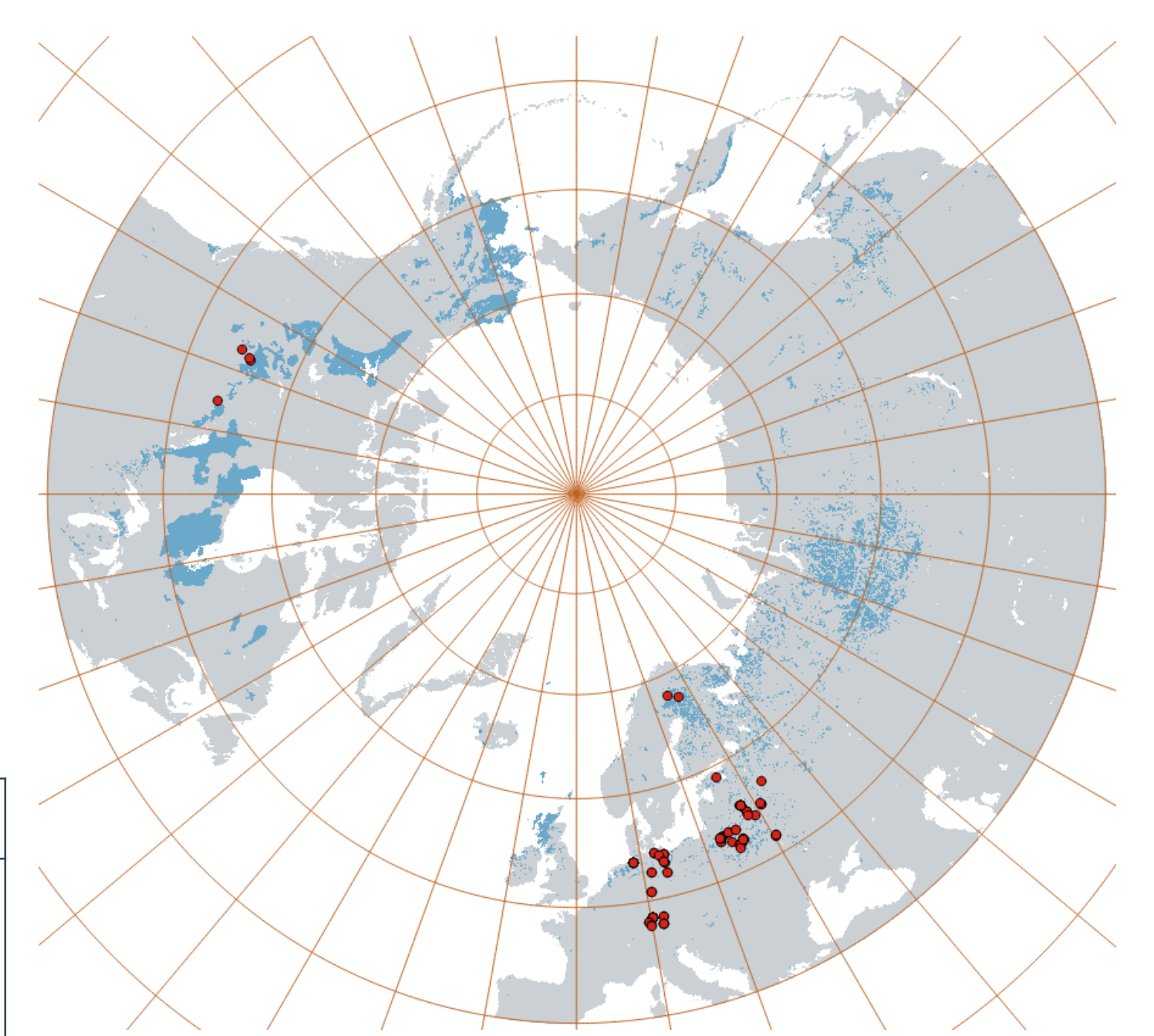
- Surface Water Storage:** Water can pond in microrelief. Water table dependent total specific yield calculated as average of soil and open water specific yields
- Single runoff function** replacing original baseflow and overland flow functions
- Evapotranspiration:** Water stress linked to water table depth
- Update of peat hydraulic properties



Simulation Experiments and In Situ Data

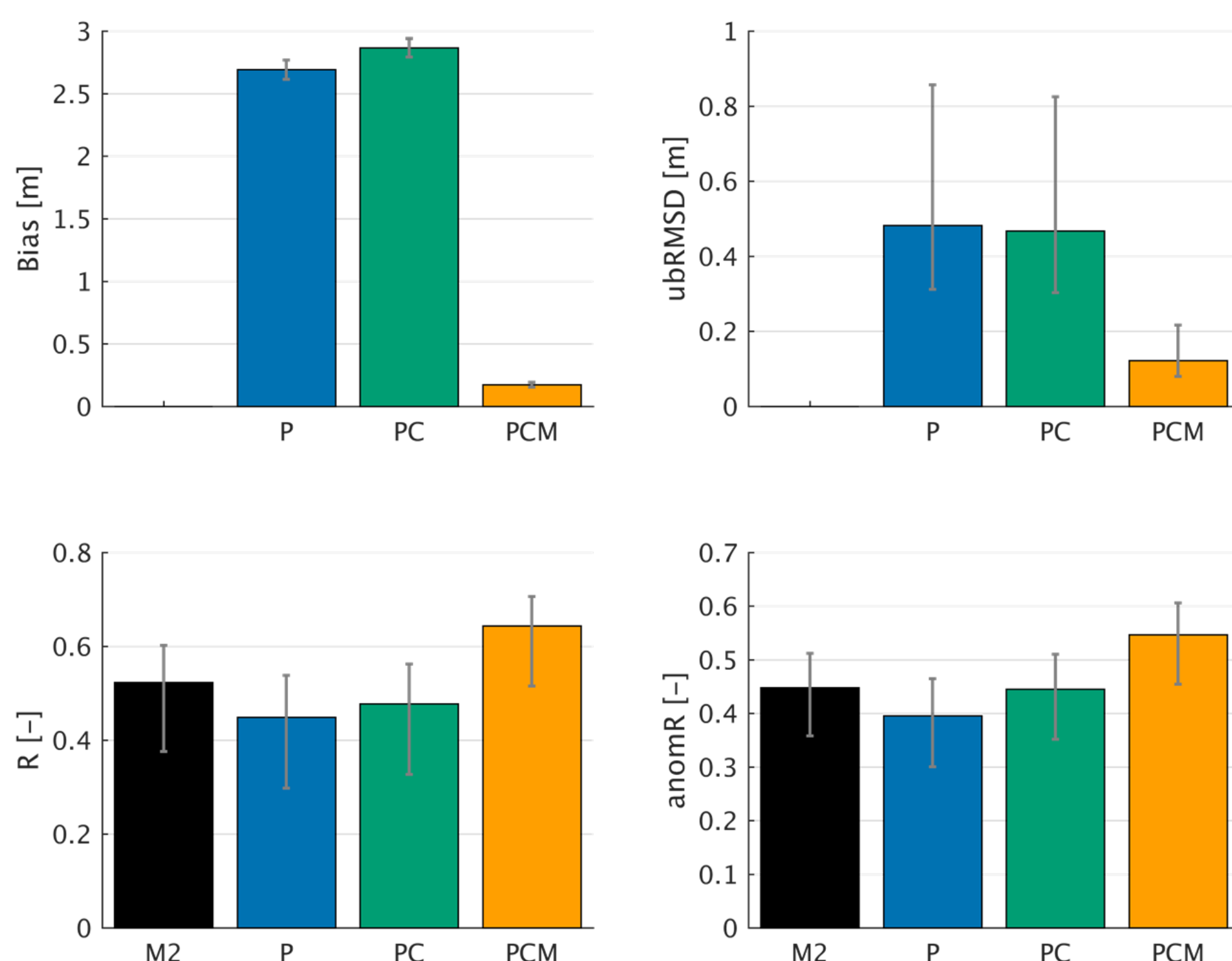
- Simulation experiments using different versions of the GEOS-5 Catchment Land Surface Model
- Domain: Northern Hemisphere
- Forcing data: MERRA-2 (corrected precip.)
- No parameter calibration for new model (PCM)
- Comparison with ~ 60 observed multi-year time series (11 clusters) of water table depth (WTD)

Experiment	M2	P	PC	PCM
Description	Operational Merra-2, only mineral soils	Revised soil input including Peat class (De Lannoy et al. 2015)	Peat class + Refined Topography and Catchment delineation	Peat class + Refined Catchments + New Model Structure
Resolution	2/3° x 1/2°	EASEv2 M09	5' x 5'	5' x 5'

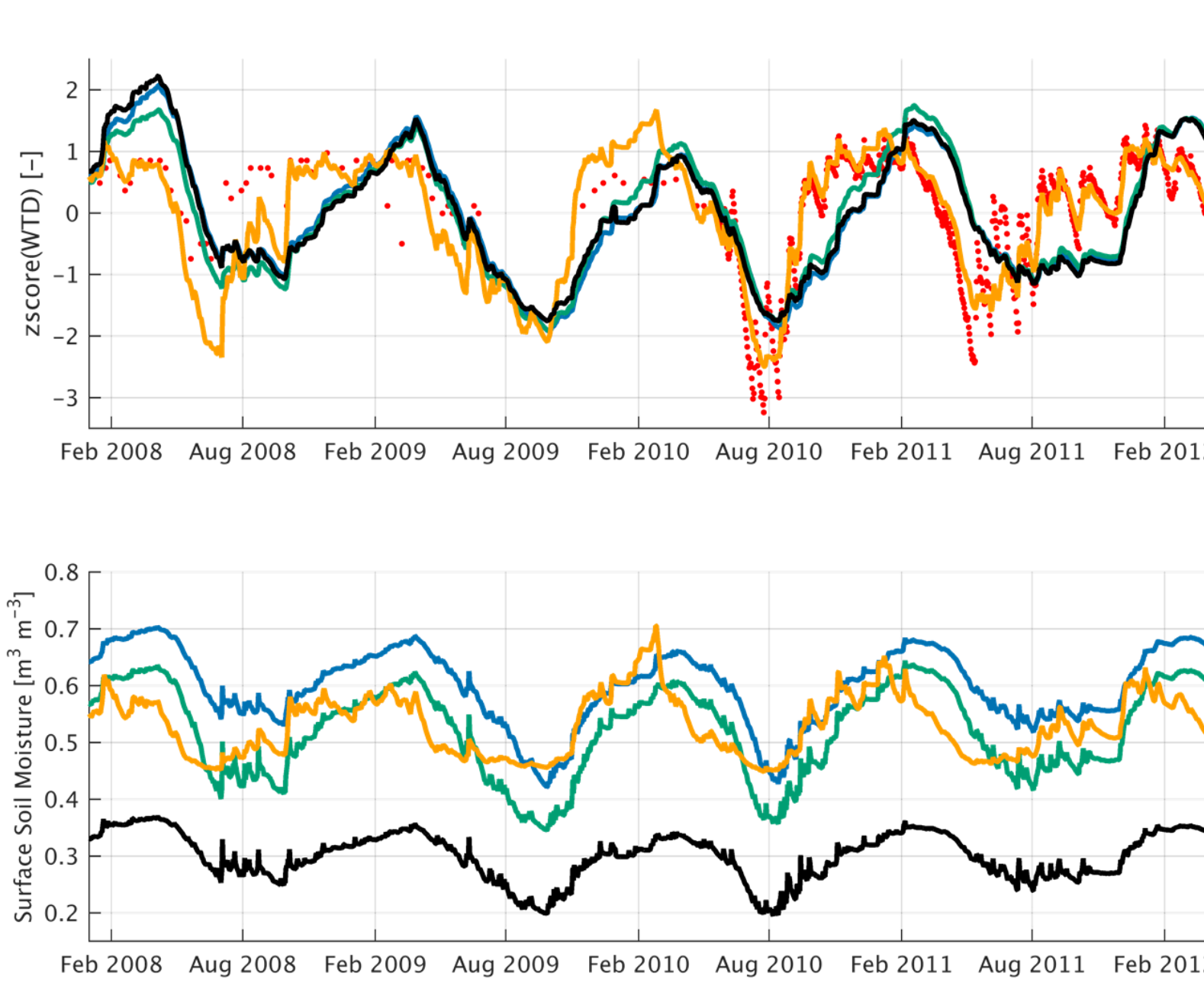


Peatlands (light blue) of the Northern Hemisphere, red dots = in situ data

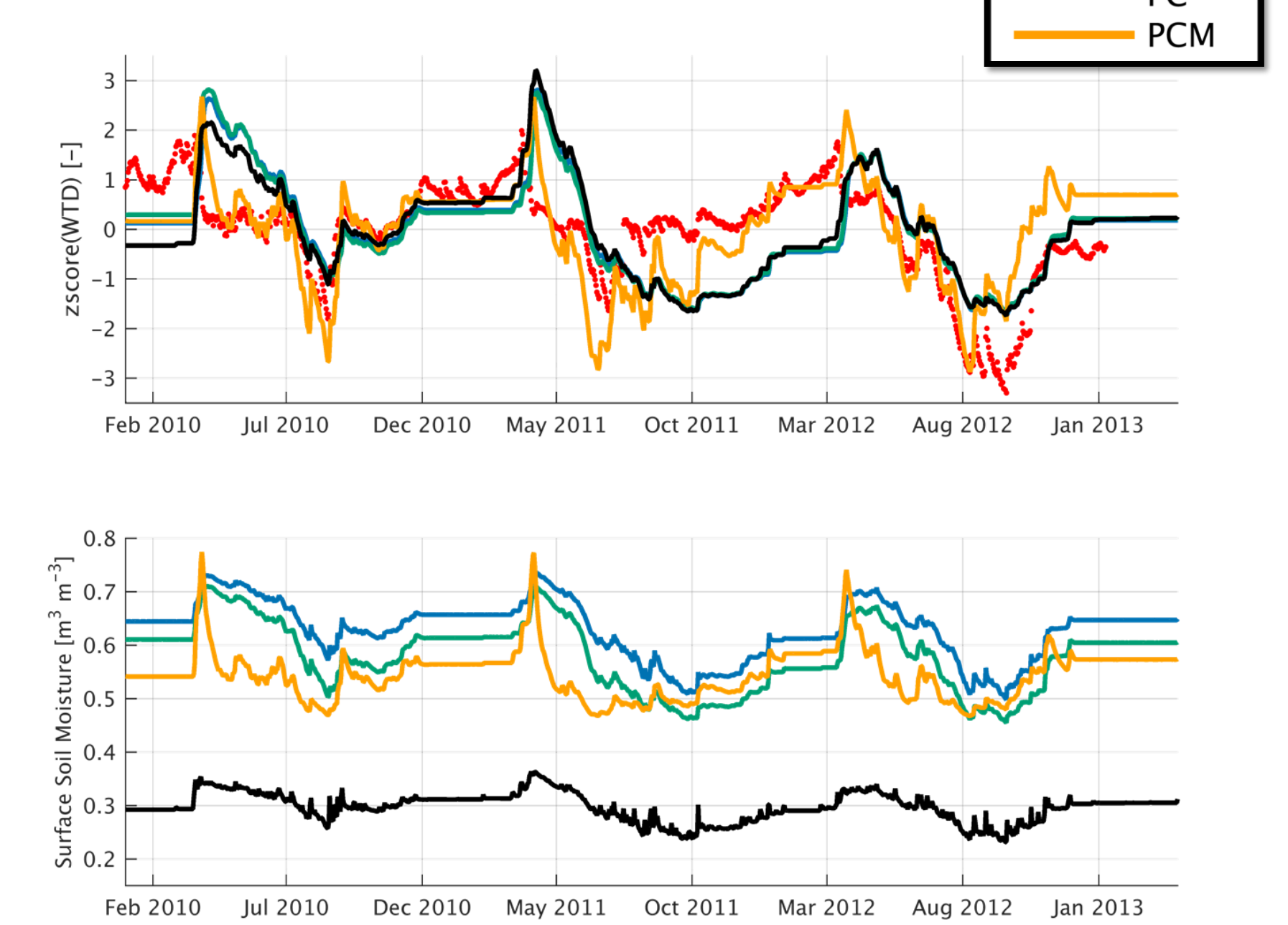
Skill Metrics and Time Series



Example 1: Bog in NW Germany
Mild winter, high precipitation, R(PTM)=0.9



Example 2: Bog in Belarus
Long freezing period, R(PTM)=0.6



Conclusions

- New model structure for peatlands results in improved skill metrics (without any parameter calibration)
- Simulated surface soil moisture strongly affected by new model, but reliable soil moisture data lacking for validation

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